

**Claims:**

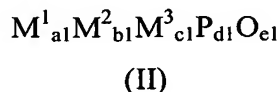
1. A photothermographic material comprising a support having thereon, one or more imaging layers comprising:
- 5 a. a photosensitive silver halide,
- b. in reactive association with said photosensitive silver halide, a non-photosensitive source of reducible silver ions,
- c. a reducing agent for said reducible silver ions, and
- d. one or more X-radiation-sensitive phosphors each of which
- 10 emits in the range of from about 100 to about 410 nm, said X-radiation-sensitive phosphor comprising a rare earth phosphate, a yttrium phosphate, a strontium phosphate, or a strontium fluoroborate.
2. The material of claim 1 comprising a cerium activated rare
- 15 earth phosphate, a yttrium phosphate, or a europium activated strontium fluoroborate as said X-radiation-sensitive phosphor.
3. The material of claim 1 wherein said X-radiation-sensitive phosphor has a zircon or monazite crystal structure.
- 20 4. The material of claim 2 comprising a europium activated strontium fluoroborate having a composition defined from the following Structure (I) as said X-radiation-sensitive phosphor:



wherein M is strontium, or a mixture of metals containing strontium and one or more of the metals Mg or Ca, F is fluoride, B is boron, O is oxygen,  $0 < a \leq 1.5$ ,

30  $0 < b \leq 0.5$ ,  $2 < c \leq 5$ ,  $3 < d \leq 7$ ,  $0 < e \leq 0.25$ , and  $0 < a + e \leq 2$ .

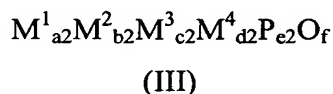
5. The material of claim 1 comprising a strontium phosphate having a composition defined by the following Structure (II) as said X-radiation-sensitive phosphor:



wherein  $M^1$  and  $M^2$  are different metals selected from the group consisting of Mg, Ca, Sr, and Zn,  $M^3$  is one or more of the metals Eu, Mn, Sn, and Pb,  $0 < a1 \leq 1$ ,  $0 < b1 \leq 1$ ,  $0 < c1 \leq 0.2$ ,  $0 < a1 + b1 + c1 \leq 2$ ,  $0 < d1 \leq 4$ , and  $0 < e1 \leq 10$ .

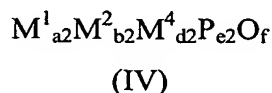
6. The material of claim 1 comprising a cerium and strontium activated rare earth phosphate or yttrium phosphate as said X-radiation-sensitive phosphor.

7. The material of claim 6 comprising a cerium and strontium activated or co-activated rare earth phosphate or a cerium and strontium activated yttrium phosphate having a composition defined by the following Structure (III) as said X-radiation-sensitive phosphor:



wherein  $M^1$  is lanthanum or yttrium,  $M^2$  is cerium,  $M^3$  is gadolinium, ytterbium, or a mixture thereof,  $M^4$  is strontium or a strontium-containing mixture of alkaline earth metals,  $0 < a2 \leq 1$ ,  $0 < b2 \leq 0.6$ ,  $0 \leq c2 \leq 0.5$ ,  $0 \leq d2 \leq 0.1$ ,  $0 < a2 + b2 + c2 + d2 \leq (e2 + 1)$ , and  $0 < f \leq (4.5e2)$ .

8. The material of claim 7 wherein said X-radiation-sensitive phosphor has a monazite crystal structure and a composition that is defined by the following Structure (IV):



wherein  $M^1$  is lanthanum,  $M^2$  is cerium,  $M^4$  is strontium or a strontium-containing mixture of alkaline earth metals,  $0.5 < a_2 \leq 1$ ,  $0.005 < b_2 \leq 0.3$ ,  $0 \leq d_2 \leq 0.1$ ,  $0 < a_2 + b_2 + d_2 \leq (e_2 + 1)$ , and  $(3.5e_2) < f \leq (4.5e_2)$ .

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9. The material of claim 1 comprising  $\text{LaPO}_4\text{:Ce}$  (P-1),  $\text{YPO}_4\text{:Ce}$  (P-2),  $\text{SrB}_4\text{O}_7\text{:Eu,F}$  (P-3),  $\text{BaMgAl}_{11}\text{O}_{19}\text{:Ce}$  (P-4), and  $\text{Sr}_2\text{P}_2\text{O}_7\text{:Eu}$  (P-5), or a mixture of two or more these compounds, as said X-radiation-sensitive phosphor(s).

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10. The material of claim 1 wherein said X-radiation-sensitive phosphor is present in an amount of from about 1 to about 20 mole per mole of total silver and the total silver present in said material is at least  $0.002 \text{ mol/m}^2$ .

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11. The material of claim 1 wherein said photosensitive silver halide and said X-radiation-sensitive phosphor are in the same imaging layer.

12. The material of claim 1 comprising the same or a different imaging layer(s) on both sides of said support.

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13. The material of claim 1 wherein said binder is a hydrophobic binder.

14. The material of claim 1 wherein said binder is a hydrophilic binder or a hydrophobic polymer applied as a water-dispersible polymeric latex.

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15. The material of claim 1 wherein said photosensitive silver halide is tabular silver halide containing an iridium dopant.

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16. The material of claim 1 wherein said non-photosensitive source of reducible silver ions is:

- a) a silver salt of a fatty acid having from 10 to 30 carbon atoms, or a mixture of said silver salts, at least one of which is silver behenate,
- b) a silver salt of a compound containing an imino group, or a mixture of said silver salts, at least one of which is silver benzotriazole, or
- 5 c) a mixture of a) and b).

17. The material of claim 1 wherein said one or more imaging layers further comprise a spectral sensitizing dye, an acutance dye, a toner, a co-developer, or a contrast-enhancing agent.

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18. The material of claim 1 wherein said photosensitive silver halide has been chemically sensitized with a sulfur-containing chemical sensitizing compound, a selenium-containing chemical sensitizing compound, a tellurium-containing chemical sensitizing compound, or a gold(III)-containing chemical sensitizing compound, or mixtures of any of these chemical sensitizing agents.

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19. The material of claim 1 wherein said imaging layer comprising said X-radiation-sensitive phosphor has a dry coating weight of at least 5 g/m<sup>2</sup>.

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20. An X-radiation sensitive photothermographic material comprising a support having on one side thereof, a photothermographic imaging layer having a dry coating weight of from about 300 to about 400 g/m<sup>2</sup>, said imaging layer comprising a binder and in reactive association:

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- a. a photosensitive silver bromide or silver bromiodide, or mixture thereof, that has been chemically sensitized with a sulfur-containing chemical sensitizing compound, a selenium-containing chemical sensitizing compound, a tellurium-containing chemical sensitizing compound, or a gold(III)-containing chemical sensitizing compound, or mixtures of any of these chemical sensitizing agents,

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b. in reactive association with said photosensitive silver halide, a non-photosensitive source of reducible silver ions comprising silver behenate, silver benzotriazole, or a mixture thereof,

5 c. a reducing agent for said reducible silver ions that comprises a hindered phenol or an ascorbic acid reducing agent, and

d. one or more X-radiation-sensitive phosphors, each of which emits in the range of from about 100 to about 410 nm, said one or more X-radiation-sensitive phosphors being present in a total amount of from about 0.5 to about 20 mole per mole of total silver, the amount of total silver being from  
10 about 1 to about 5 g/m<sup>2</sup>, and

said X-radiation-sensitive phosphor having a monazite crystal structure and a composition that is defined by the following Structure (IV):



wherein M<sup>1</sup> is lanthanum, M<sup>2</sup> is cerium, M<sup>4</sup> is strontium or a strontium-containing mixture of alkaline earth metals,  $0.5 < a2 \leq 1$ ,  $0.005 < b2 \leq 0.3$ ,  $0 \leq d2 \leq 0.1$ ,  $0 < a2 + b2 + d2 \leq (e2 + 1)$ , and  $(3.5e2) < f \leq (4.5e2)$ .

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21. The material of claim 20 further comprising the same or a different photothermographic imaging layer on the backside of said support.

22. A method for forming a visible image comprising:

25 (A) imagewise exposing the photothermographic material of Claim 1 to X-radiation to form a latent image, and

(B) simultaneously or sequentially, heating said exposed photothermographic material to develop said latent image into a visible image.

30 23. The method of claim 22 for providing a radiographic image of a human or animal subject.

24. The method of claim 22 comprising using said visible image for a dental diagnosis.

25. A method for forming a visible image comprising:

5 (A) imagewise exposing the photothermographic material of Claim 20 to X-radiation to form a latent image, and

(B) simultaneously or sequentially, heating said exposed photothermographic material to develop said latent image into a visible image.

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